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Industrial Welfare and Personnel Management

The Council of Ironfoundry Associations is running a series of bulletins on this important question. The introductory bulletin to the series admirably indicates the nature of the problem and the general approaches to its solution. This is indeed a difficult problem upon which to generalise as *grace à Dieu*, the time has not yet arrived when barmaids all have red hair or babies' blue eyes. Being a problem of the individual or, at best, small groupings, the position is crystal clear—that is—the representative of the management must know how to keep a mental record of the home circumstances, hobbies and ambitions of every one of the employees. No questionnaire will produce the required information. Fortunately, however, one will not go far wrong in dividing the workpeople into groups—those capable of utilising their spare time to some useful or harmless occupation, and those who require guidance. The former class are as a rule well able to take care of themselves and can usefully be left alone. For the second type—the girls who divide their leisure between the cinema and the dance hall, and the youths who are crazy about the dogs, amusement galleries and street corner lounging—there is much to be done. Moreover, as indicated, there is no clear-cut method of making this class serious minded—each one must be tackled separately. Evening classes will not attract them and entrance into recognised youth movements may have an adverse effect on their usefulness—especially if there be mass recruitment.

A question always requiring constant supervision is the foreman's liver, because should this be out of sorts for any lengthy period, much internal unrest can be engendered. Another factor which creates trouble in works, and which is often difficult to diagnose and still more difficult to overcome, is where an individual is of sterling worth, but a near relative for some reason causes anxiety. Thus the personnel manager having a staff of 500 to supervise, may have to keep under review nearly double that number to be sure that the best services are to be had from each under contented conditions. Much good can be done by an examination of the transport facilities between home and works, for in his special capacity he can often effect material improvements. Obviously, he should have available a list of lodgings, and, moreover, this list should be "approved" by him or his deputy. Special interest should be taken in holidays, for here can be a lever to make the dog-racing and dance hall "fans" have an added interest, which, if discreetly directed, can change the whole mental outlook of youth, especially if it can be related to normal evening or week-end activities.

It is pleasing to note that the succeeding C.F.A. bulletins have dealt very largely with the theoretical aspect of the problem and its indirect application to practical requirements. The series takes a much more objective view than we have done, and this is all to the good because industrial welfare and personnel management is not a physic to be pushed down the throats of recalcitrant foundrymen. It is only from an appreciation of the psychological background of the problem that applications of character suitable to the varying classes of foundry can be made. When this is fully understood it can become a panacea, but like all other remedies there is no magic in the name, it has got to be worked and developed before it can gather momentum. The problem is now receiving attention in all teachings of industrial management, for without a sound knowledge of human relations but little worthwhile progress will be made.

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A GOOD RECORD

Mr. P. T. Holligan, reporting as chairman of the technical committee of the Association of Bronze and Brass Founders, recalled that the committee was formed on October 21, 1942, with Mr. G. T. Hyslop in the chair. Since that time a large number of matters have been dealt with, and these may be summarised as follow:—

Fuel and power.—A special fuel efficiency sub-committee was formed, the representatives of which attended a conference called by the Ministry of Fuel and Power to devise means of effecting fuel economy in foundries. In particular, most valuable summaries of fuel consumption figures in the non-ferrous industry were prepared by Mr. Harbach, who was complimented by the Ministry for his outstanding efforts in this direction.

Crucibles.—The committee met representatives of the Federation of Crucible Manufacturers at a time when crucible life was showing marked deterioration due to a shortage of the best qualities of graphite. This joint conference enabled us to put before the crucible manufacturers the difficulties of foundries and, as a result, improvement in crucibles was effected.

Non-ferrous Metals Control.—The co-operation of the technical committee was requested by Ministry of Supply, Non-ferrous Metals Control, in economising in tin by the use of lower grade gunmetals and cast brasses. A joint report was issued by the I.B.F., A.B.B.F., B.N.F.M.R.A. on this subject.

B.S.I. committee on cast-copper alloys.—Members of the technical committee have represented the A.B.B.F. on the B.S.I. NF.14 committee, and have assisted in the compilation of the draft code of procedure for the inspection of copper-base alloys which has now been circulated to the industry.

B.S.I. committee on foundry equipment and patterns. The Association has been represented on the B.S.I. ME/22 committee dealing with foundry equipment and foundry patterns.

Inspectorate of Fighting Vehicles.—An inspection instruction was drawn up by the I.F.V. which, in the opinion of the technical committee, would prove impracticable and costly. A sub-committee was therefore appointed to meet representatives of the I.F.V. who were most co-operative, and finally an agreed instruction has been issued to the industry.

Experimental foundry.—The possibility of an experimental foundry being put down for use by members of the A.B.B.F. has been given very full consideration, and meetings have taken place with the director of the B.N.F.M.R.A. in an attempt to devise a scheme. The project has been shelved on financial grounds, but a useful survey of the possibilities of co-operation with existing bodies, such as the B.N.F.M.R.A. has been made.

S.M.M.T.—A joint sectional committee of the S.M.M.T. and A.B.B.F. and a joint technical committee have been formed. Proposals have been submitted to the S.M.M.T. for the standardisation of a limited number of copper-base alloy specifications.

Control commission for Germany.—A visit has been paid to Germany by a team representing the Association, and a full report has been issued to all members.

Proposed prohibition of siliceous parting powders in foundries.—The Ministry of Labour has issued a draft of a proposed regulation prohibiting the use of siliceous parting powders in foundries. The technical committee has recommended (*a*) that a short period be allowed for the changeover from siliceous to non-siliceous parting powders; and (*b*) that the use of sea sand be permitted for certain castings, provided that not more than 1 per cent. will pass through a 300-mesh sieve.

I.B.F. education sub-committee.—The committee is represented on the I.B.F. London branch, education sub-committee.

Canadian leaded bronze.—The committee has considered the proposal by Mr. Roast, of the Canadian Bronze Company, advocating the adoption of 7 per cent. tin, 15 per cent. lead, 3 per cent. leaded bronze in this country, and is of opinion that there is no case for its adoption.

Technical assistance to members.—The committee has considered a number of technical queries put forward by members, and in conjunction with Mr. F. Hudson, of Mond Nickel Company, Limited, has made suitable recommendations.

NEW CATALOGUE

High Duty Cast Iron. Sykes & Harrison, Limited, of Percy Street Foundry, Manchester, 4, have sent us a well-illustrated 36-page brochure bound in black cloth. In it are given very clear details of the control imposed; why the firm refuses to sell at a price per cwt.; an appeal for co-operation in design to render the job suitable for foundry production, and analogous information. This done, attention is directed to "Acculite," the firm's particular brand of high duties. First, a review is given of the existing B.S. specification, followed by a note of the properties not so covered, such as permanent set, shear and torsional strength, fatigue, impact and damping capacity. In this latter case some quite useful examples from practice are disclosed. After a few notes on heat-treatment (including flame hardening), a section is devoted to microstructure, for the illustration of which some excellent photomicrographs are included. If the object of the brochure is to give confidence to the buyer, that the supplier is fully alive to his problems, and possesses the means and control to effectively solve them, then success has been achieved. The brochure is available to our readers at a cost of 5s., and as an essay on enlightened control it is well worth it.

CONTROL TESTS FOR GREY CAST IRON*

Report and recommendations of Sub-Committee T.S.6. of the Technical Council

Constitution of the Sub-Committee

The Sub-Committee was appointed by the Technical Council on June 27, 1944, under the chairmanship of Mr. J. Blakiston, A.M.I.Mech.E., and with the following Terms of Reference:—

To investigate and make recommendations on rapid forms of shop control tests mainly applicable to molten grey cast iron.

The membership of the Sub-Committee is as follows: Mr. J. Blakiston, Modern Foundries, Limited, Halifax (chairman); Mr. J. H. D. Hobson, Tees Side Bridge & Engineering Works, Limited, Middlesbrough (deputy chairman); Mr. C. W. Hicks, Humber, Limited, Coventry; Mr. I .S. Harrison, later succeeded by Mr. N. Cartwright, Coneygre Foundry, Limited, Tipton; Mr. H. P. Hughes, Thomas Robinson & Company, Limited, Rochdale; Mr. C. A. Payne, B.Sc.(Hons.), Qualcast, Limited, Derby; Mr. T. H. Taft, who was represented at most meetings by Mr. A. D. Morgan, Idoson Motor Cylinder Company, Limited, Smethwick; Mr. T. R. Twigger, British Piston Ring Company, Limited, Coventry; Mr. K. H. Wright, C. Akrill, Limited, West Bromwich; Mr. W. Jones, Hepworth & Grandage, Limited, Bradford, served as a member of the Committee under Mr. J. W. Gardom's Technical Council Students' scheme; Mr. J. Bolton, Acting Secretary of the Institute, was Secretary of the Sub-Committee. Mr. Hobson served as chairman of the Sub-Committee between February and September, 1945, during Mr. Blakiston's absence abroad.

Introduction

The purpose of this Report is to review quick check tests which may be made on grey cast irons to ensure that metal delivered from a foundry melting furnace is suitable for the casting or castings for which it is intended. In jobbing foundries where the value of individual castings is often great, the intelligent use of these tests will enable metal unsuited to a particular casting to be diverted to other work for which it may be satisfactory, thus helping to minimise the production of wasters. Similarly, in mechanised foundries where a considerable value of castings can be produced in a very short time, while it is usually impracticable to conduct any test on the molten iron before pouring, it is possible by means of these check tests to minimise the number of moulds poured before test results are available to show whether rectification of the metal is necessary. This naturally implies that the tests to be described must be capable of execution in a very short time, preferably between the time the molten metal is ready and pouring it into the moulds.

In some cases this is possible; in others, particularly batch production and repetition foundries where the results of some tests cannot be made available before the sampled metal is cast, it is also of great advantage to carry out other slightly more prolonged tests the results of which can be used to check the suitability of subsequent metal. Even in these cases, however, the

TABLE I.—*Wedge Dimensions and Test Times.*

Wedge.	Base (B).		Height (H).		Length (L).		Time taken to complete test.
	In.	Mm.	In.	Mm.	In.	Mm.	
A	$\frac{1}{4}$	6	$\frac{7}{16}$	11.1	$2\frac{1}{4}$	57.1	35 sec.
B	$\frac{1}{2}$	12.7	$\frac{7}{8}$	22.2	4	101	40 sec.
C	$\frac{3}{4}$	19	$1\frac{1}{2}$	38	5	127	1 min.
D	1	25.4	$2\frac{1}{4}$	57.1	5	127	$1\frac{1}{2}$ min.
E	$1\frac{1}{2}$	38	$3\frac{3}{8}$	85.7	6	152	3 min.
F	2	51	$4\frac{3}{4}$	120.6	6	152	10 min.
G	$2\frac{1}{2}$	63·5	$6\frac{1}{2}$	165·1	8	203	15 min.
H	3	76.2	$8\frac{1}{2}$	215.9	8	203	20 min.

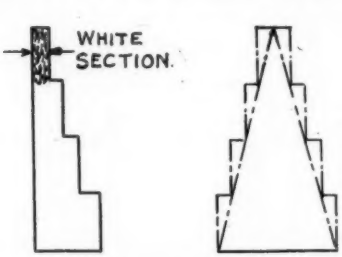


FIG. 1.—STEP BAR TEST-PIECE.

* A Paper read before the 43rd annual conference of the Institute of British Foundrymen, Birmingham, June, 1946.

speed with which the results may be obtained on the foundry floor is the criterion by which the usefulness of the tests for control purposes will be judged, since it is obviously important to minimise the number of castings produced between sampling and making any corrections shown to be necessary.

It will be appreciated that the time available for the execution of tests made with a view to checking the sampled metal before casting will vary from one foundry to another, according to the type of casting produced and the melting media available. For example, no difficulty is experienced in employing analytical methods where melting media (such as air, electric and rotary furnaces or cupolas with efficient receivers) are employed which permit the molten metal to be held for a specific period without excessive change in chemical composition.

It is because of this wide variation in conditions that the Sub-Committee cannot be dogmatic in its recommendations of the most adequate types of tests. Certain standards can, however, be applied in many sections of the industry regardless of the fact that the wide range of foundry manufactures demand extreme variations n testing practice and that specialised foundry conditions and new techniques will demand variation of the numerous examples cited.

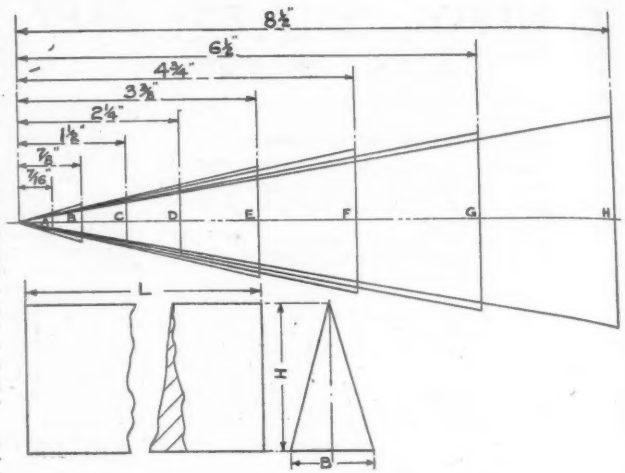


FIG. 2.—DIMENSIONS OF EIGHT SIZES OF WEDGE TEST-PIECES.

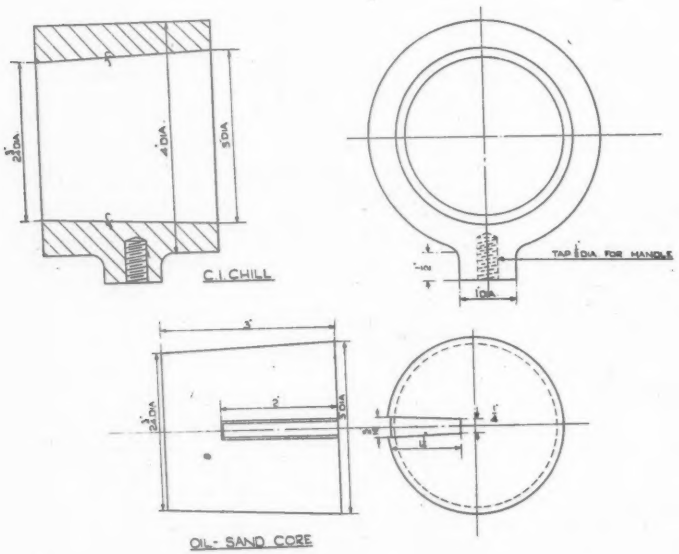


FIG. 3.—B.C I.R.A. TYPE OF CHILL TEST.

It must be clearly understood that the tests enumerated are for control purposes only and are conducted ancillary to the final metallurgical and laboratory examination normally carried out for inspection purposes. Such control tests are usually operated by comparison with previously prepared standard test-pieces, figures or other data prepared in respect of any particular foundry's production conditions and output, and in this respect they resemble the normal comparator methods practised in general engineering.

It is imperative that all the test conditions should be standardised, maintained and recorded to enable proper comparisons to be made and, furthermore, although speed is the principal criterion, accuracy should not be unduly sacrificed, although in certain circumstances some latitude may be permissible.

In view of the importance of temperature determination in ensuring standard test conditions, a number of quick, reliable methods of temperature recording are reiterated in Appendix A to render the report more widely acceptable. The importance of maintaining proper temperature control in all processes cannot be too strongly emphasised.

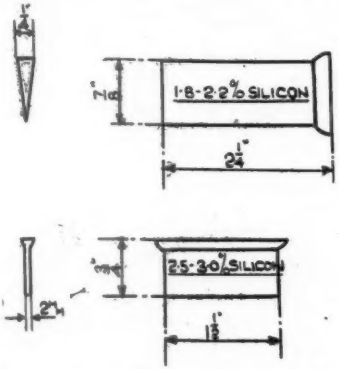


FIG. 4.—CHILL TEST-PIECE AS USED FOR SEPARATELY-CAST AUTO PISTON RINGS.

The tests to be described may conveniently be divided under three main headings, as follow:—

(1) Visual tests or those which quickly produce some directly observable characteristic phenomena in the actual metal.

(2) Rapid analytical methods.

(3) Mechanical tests which in many cases merely anticipate those subsequently required by inspecting authorities.

Visual tests will almost certainly be found to have the widest application, principally because only a very short time elapses before the results may be acted upon. Under this heading recommendations are made for standardising a series of wedge test-pieces which experience has shown are the most economical to produce to represent the wide range of castings made by the industry. The Sub-Committee also record a number of shrinkage tests commonly employed and recommend a U-type test-piece for measuring fluidity.

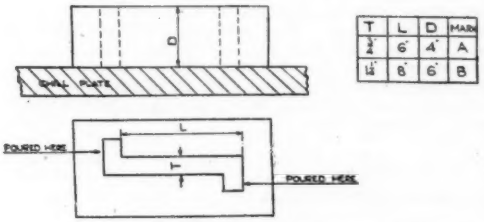


FIG. 5.—TYPE OF TEST-PIECE USED FOR CONTROLLING HEAVY-SECTIONED CASTING.

In the analytical section of the report the possibilities and limitations of spectrographic and colorimetric methods are discussed, but in general results from these latter methods are only applicable to the correction of metal produced subsequent to that from which the sample has been taken. Appendix B records the usual wet analysis methods and gives useful hints on means of reducing operation times.

Tensile, transverse, impact and hardness testing is discussed in Section 3 from the point of view of control purposes only, but here again the length of time

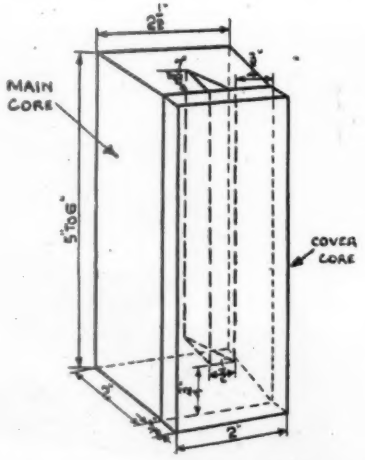


FIG. 6.—ALTERNATIVE CORE FOR V-TYPE CHILL TESTS.

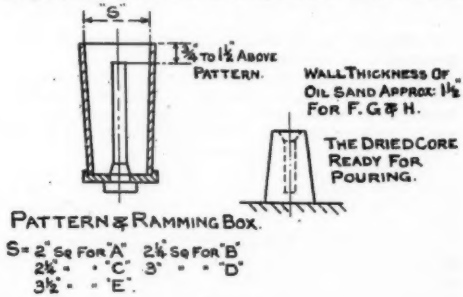

"S"
1¾" TO 1½" ABOVE PATTERN.
WALL THICKNESS OF OIL SAND APPROX: 1½" FOR F. G & H.
THE DRIED CORE READY FOR POURING.
PATTERN & RAMMING BOX.
S= 2" SQ FOR "A" 2½" SQ FOR "B"
2½" " "C" 3" " "D"
3½" " "E"

FIG. 6A.

Control Tests for Grey Cast Iron

involved in cooling test-bars and preparing the specimens is such as to limit the usefulness of this type of test to repetition and batch production foundries.

Section 1. Visual Tests

(*a*) Chill Tests

Different types of cast iron usually exhibit well-marked differences in their tendency to chill when quickly cooled from the molten state. This chilling tendency is related to melting conditions, the chemical composition of the material, notably as regards carbon and silicon contents, and also to the mechanical properties of the casting. In a casting of normal thickness one iron may, for example, exhibit no chilled portion, another grade of iron would produce a casting having a completely white fracture, while an intermediate grade of iron would produce a casting having a fracture partly grey and party white.

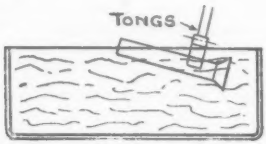


Fig. 7.—Showing Method of Quenching.

Fig. 8.—Bench Plate for Fracturing Samples.

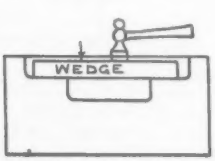


Fig. 9.—Breaking Block.

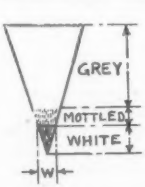


Fig. 10.—Showing Colour Distribution in Fracture.

Commonly used test-pieces for judging the chilling propensity of the material are:—

(*a*) *Wedge Test-pieces,* which are a development of the step bar (Fig. 1), having a uniformly increasing thickness of cross-section. This feature enables a more accurate determination of the chill to be made, and is therefore more generally adopted.

(*b*) *Forced Chill Test-pieces,* frequently taking the form of a wafer or rectangular slab, having one edge adjacent to a metal plate which rapidly cools the molten iron.

(*c*) *Stepped Test-bars* having perhaps four or five progressive changes in section thickness, are of considerable value in experimental work in connection with jobbing production to assess the suitability of a given mix of iron to any particular casting or range of castings showing a wide variation in section thickness. Alternatively, the test may be employed to ascertain the widest possible range of sectional thicknesses which can be cast with any required fracture from any given mix of iron.

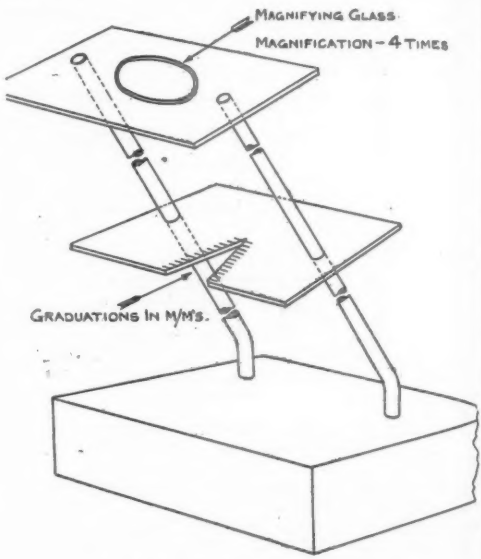


Fig. 11.—Wedge Measuring Gauge.

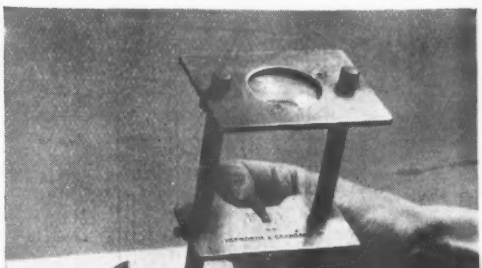


Fig. 11A.—Arrangement for the Rapid Reading of White Fracture Dimensions.

TABLE II.—*Typical Relationships between Charge Composition and Wedge Readings on Inoculated Steel Mix Irons.*

B.S. 786.		Steel in Cupola Charge. Per cent.	Inoculant. oz. per ton FeSi (70-75 Per cent. Si).	Wedge Readings in mm.		Tensile Strength Obtained. Tons per sq. in.
Grade.	Min. Tensile. Tons per sq. in.			Composition.	Ladle.	
I	14	20	100/120	C6—C8	B3—B5	16—19
II	17	33⅓	200/240	D10—E14	C5—C8	19—21
III	20	50	320/400	E14—F20	C6—D10	21—24
IV	23	75	500/550	G25—H40	D8—D14	26—28

Wedge Dimensions.—In order to minimise the time required for carrying out the test, and to avoid excessive cost of testing, the test-piece should be the smallest possible consistent with giving a reasonable proportion of white to grey fracture with the particular type of iron in use. Eight test-pieces designated "A" (smallest) to "H" (largest), detailed in Fig. 2 and Table I, are recommended for standardisation.

Selection of Test-pieces.—An iron required for thin-section castings will usually have high total carbon and high silicon contents in order to avoid chilled sections in the castings themselves. Such irons would therefore show little, if any, chill in the test-pieces. The small wedge test-pieces "A," "B" or "C," or the British Cast Iron Research Association test-piece (Fig. 3), or one of the small wafer test-pieces (Fig. 13), would generally be used. Where castings are of exceptionally thin section, as in single-cast piston rings, a special wafer test-piece, as Fig. 4, is appropriate.

Iron required for heavier section castings requiring high strength or high hardness would show a completely white fracture in the small test-pieces; therefore, one of the larger wedges "D," "E," "F," "G" or "H," or the rectangular test-piece (Fig. 5), should be used. It is convenient to select a wedge test-piece which, for the particular grade of iron concerned, will show at the point where the white fracture blends into the grey, a width less than one-half the base width of the wedge.

Moulds for Test-pieces.—To avoid variations which might arise with green-sand moulds through difference in moisture content, permeability and other effects, moisture resistant oil-sand moulds are recommended. Stocks of moulds or cores should always be available. Generally, for casting purposes, the cores for the larger test-pieces are set in a moulding box packed with floor sand. It is essential that the patterns for test-pieces should be kept in good condition as regards shape and dimensions. Polished metal patterns with stripping plates, as indicated in Figs. 6 and 6A, are recommended.

TABLE III.—*A Typical Relationship between Composition Wedge (CW) and Ladle Wedge (LW) for a Particular Type of High-Duty Iron.*

B.S. 786.	Ratio CW to LW.*
Grade I	1½ to 1
,, II	2 to 1
,, III	2½ or 3 to 1
,, IV	3 or 4 to 1

* Applicable to all wedge sizes.

Test Procedure.—A sample of the molten metal is taken from the melting or holding furnace or casting ladle as desired, in a clean preheated sampling ladle for pouring into the appropriate test core. Pouring temperature should be standardised and preferably checked pyrometrically. When the metal has solidified, the core is broken away; by this time the casting will be a dull red (about 600 deg. C.), and it should then be quenched in a bath of water of ample capacity. Care should be taken in quenching. The base side of the test-piece should be the first to enter the water to obtain a good contrast in the colour of the fracture (Fig. 7). The test-piece should also be moved quickly in the water to avoid a violent evolution of steam. The sample is preferably removed from the water while still warm, so that the surface water immediately dries off before breaking the sample upon a bench plate (Fig. 8) or upon a breaking block (Fig. 9).

The fractured section should then clearly indicate a white area at its tip, according to composition and melting conditions (Fig. 10). It is the measurement of the base dimension "W" in millimetres of this white area which is taken as the wedge reading. Fig. 11 shows a useful device for quick appraisement.

In test-pieces where "W" measures 5 mm., 10 mm., and 20 mm., the wedge readings are known as 5, 10 and 20 respectively, but to make the references more complete the size of the bar used should be stated. The above readings would then be known as B5, C10 and E20, indicating that bars B, C and E had been used for these tests. All tap numbers, wedge readings and relevant information should be recorded in the foundry at the time the tests are being taken.

Applications.—Wedge test-pieces of the appropriate size are of the greatest possible value in the regular control of iron required to meet specifications such as B.S. 786. Some of these grades of iron may be cast direct from the melting furnace without further treatment. For the higher strength grades of this specification it is common practice to run the furnace metal harder, *i.e.*, low in total carbon and silicon, by the incorporation of a high percentage of steel scrap in the furnace charge. A late addition of some graphitising

Control Tests for Grey Cast Iron

element is then made to the molten metal at the furnace spout or ladle, whereby excellent mechanical properties can be obtained.

Apart from its usefulness as a means of checking the consistency of the metal at the furnace spout (Table II), wedge tests are also most useful in checking the relationship between the chilling tendency of the metal before and after the graphitiser has been added. It is thus apparent that, for such inoculated irons, two distinct wedge control tests should be made. The first of these tests, being a result of the composition of the charged materials and the conditions of melting, may be termed "composition wedge," "basic wedge," "furnace wedge" or "spout wedge." In this report, the term "composition wedge" is adopted. The second test, being a result of the metal finally treated and ready for pouring from ladle to mould, will be designated "ladle wedge."

It has been found that the relationship of "composition wedge" to "ladle wedge" is usually a good index of the final mechanical properties of the casting. A general relationship for an inoculated steel mix iron is indicated by the graphs, Fig. 12, and by Table III, but it must not be assumed that the particular ratios shown can be applied indiscriminately to all types and grades of iron. Similar ratios for other irons may, however, be found by experience.

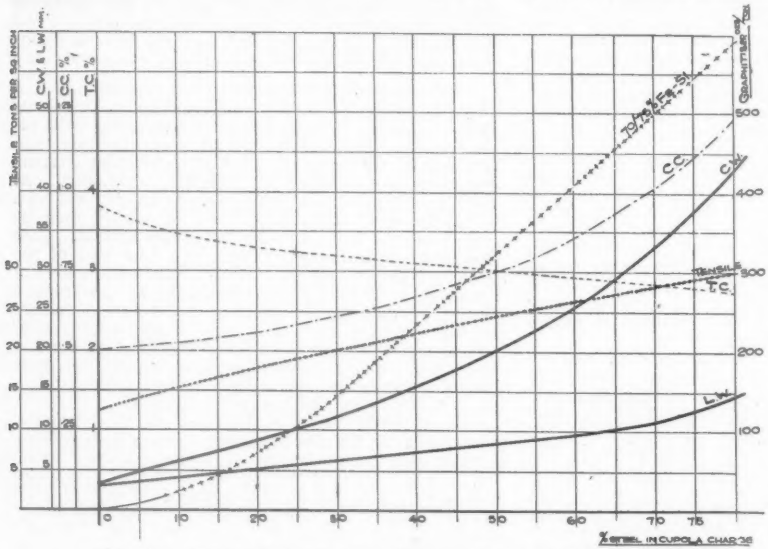


FIG. 12.—GRAPH SHOWING RELATION OF TYPICAL COMPOSITIONS.

When considering easy machinability, especially of thin section castings, it has been observed that the ladle wedge reading bears a relationship to the thickness of the casting produced. For general engineering purposes the following proportions have been found satisfactory:—

$$\frac{T}{4} = W \text{ (max.) for thin castings.}$$

$$\frac{T}{3} = W \text{ for thick castings.}$$

Where T = thickness of section in millimetres.
W = ladle wedge reading in millimetres.

Forced Chill Test-pieces.—Upon referring to the composition and ladle wedge curves in Fig. 12, it will be observed that for soft irons of high total carbon content, the readings of these curves are low and have a close ratio. Such irons do not produce an appreciable chill by normal cooling. It therefore becomes necessary to substitute or supplement the wedge test by test-pieces which depend upon forced methods for producing the chill, such as by pouring the molten metal on or against a chill plate. It is important that the material from which the chill plates are made be standardised to make results comparable, and that the quality and thickness of the chill dressing is maintained. Either cast iron or, more rarely, copper chills are employed. The thickness of the plate is also important, and the Sub-Committee recommend a minimum thickness of 1½ in.

Test-pieces which come under this classification are known as the "wafer" and "rectangular." The form and dimensions of recommended wafer test-pieces for thin-section castings are given in Fig. 13, while Fig. 4 shows a wafer test-piece used in the manufacture of very thin separately-cast piston rings.

The rectangular chill is usually of smaller cross-section than the corresponding wedge, and therefore has a shorter cooling period, which is an advantage when the time available for testing is limited. Fig. 5 illustrates a test-piece suitable for heavy castings. For easy and rapid sampling from large ladles or furnace baths, it is advantageous to use two small sampling ladles with long handles. The test-piece is then poured simultaneously at each end as shown. Modified forms of chill test-pieces are given in Figs. 14 and 15.

Correlation of Wedge and Wafer Tests.—Results of one series of comparative tests carried out with wedge and wafer chills are given in Fig. 16. From these results it is concluded that the forced chill reading is approximately double that of the corresponding wedge reading.

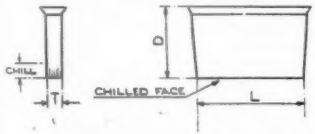
Expressed as an equation $C = 2W + 1$.

Alloy Cast Irons.—These may be treated in a similar manner to the compositions referred to, but when an iron contains a specially added element or elements in sufficient quantities to produce a considerable modification to the mechanical properties, the composition and ladle wedge readings will vary in accordance with the proportions of alloying elements included. Curves similar to those of Fig. 12 may then be plotted for any particular alloyed iron.

(*b*) Shrinkage Tests

Factors Involved.—The shrinkage of molten grey cast iron is not uniform and varies with the constitution of the metal, the mass, the area of section of the casting and the rate of cooling. Early work carried out by Keep showed that white irons produced greater shrinkage than grey irons, due to the suppression of graphitisation consequent upon a low silicon content. Shrinkage may be considered in three parts:—

(1) *Shrinkage in the liquid state,* which takes place between the pouring and freezing temperatures. This means that unless progressive solidification occurs as the mould is filled, additional metal must be supplied to the solidifying casting to ensure soundness.



T	L	D	MARK
1/8"	1 1/2"	3/4"	A
1/4"	2"	1"	B
3/8"	2 1/2"	1 1/2"	C

Fig. 13.—Wafer Test-pieces.

(2) *Shrinkage on solidification,* which is largely influenced by the amount of graphitic carbon present.

(3) *Shrinkage in the solid state,* which takes place between the solidification temperature and normal room temperature. This shrinkage, generally termed "pattern-makers' shrinkage or contraction," is compensated for by making the pattern larger by the amount of shrinkage characteristic of the metal used.

Control tests may be applied to determine the shrinkage characteristics of metal throughout each of these stages.

Shrinkage in the Liquid State.—Shrinkage in the liquid state is frequently counteracted by additions of molten metal to the mould, but when some visual test is desired (apart from feeder heads), chiefly as a check upon pouring temperatures, two simple methods are available. These tests are similar. one being in the form of a cone (Fig. 17) and the other in the form of a pyramid having 4-in. sq. base by 4-in. perpendicular height (Fig. 18). Both are poured in cast iron chill moulds and the amount of shrinkage or sinking at the surface may be measured by comparative observation or the volume may be quantitatively determined.

When the formation of crystal structures is considered in relation to these tests, it will be appreciated that the cone test, being of circular cross-section, provides uniform cooling and that segregation, slag and dirt inclusions will group towards the centre, whereas in the pyramid test these inclusions assemble at right angles to their cooling surfaces, forming diagonal planes over a large area, as is indicated in Fig. 18, thereby making these inclusions more difficult to locate in the test-pieces.

Molten metal, correctly melted and poured into moulds, should, after solidification, produce a concave surface, but metal subjected to poor melting conditions (sometimes termed "oxidised" or "over-reduced" metal and caused chiefly by excessive blast or low coke bed) is affected by the amount of gases held in solution in the molten metal. Upon cooling, the surface of this latter type of metal does not sink, and may even rise in places and present a surface resembling the head of a cauliflower. Metal which is affected through melting conditions may, during solidification, liberate gases through fine pores at the surface, forming small globules from which the condition of the metal may be judged. A small number of globules would probably correspond with a sound casting, whereas metal with a large num-

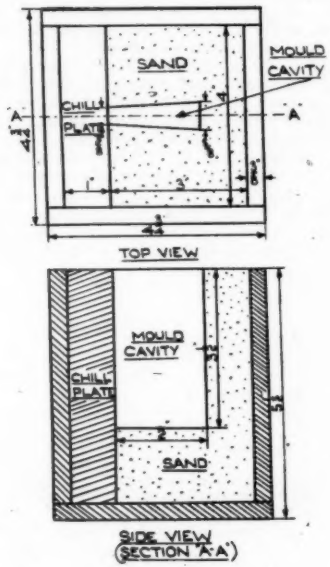


Fig. 14.—Sample Type of Chill Test Mould.

Control Tests for Grey Cast Iron

ber of globules would produce castings with porosity, gas holes, and draws at intersections or junctions of different cross-sections. The pyramid test-block having a larger surface than that of the conical block is more sensitive when used for this purpose.

When dealing with iron of low carbon and low silicon contents, a further test for "cauliflowering" can be made in the form of a cylindrical slab 8, 10 or 12 in. dia. by 6 in. thick. This test-piece may be cast in an open sand mould, poured through an overhead runner box with slag trap to ensure a clean surface.

In order to obviate the adverse effects of damp moulds, all chills and cores for use in the foregoing shrinkage tests should be well dried.

Shrinkage on solidification. Many writers have contributed to this subject and this report would be incomplete if reference were not made to Keep's cooling curve machine and Turner's extensometer. It is considered that both these well-known methods could with advantage be developed for foundry control purposes.

Keep's test bars for the measurement of linear shrinkage comprise ½-in. sq. bars 12 in. long or 1-in. sq. bars 24 in. long. These are mounted in parallel on a pattern board and a skim gate and iron chill blocks placed at the end of the patterns. When the

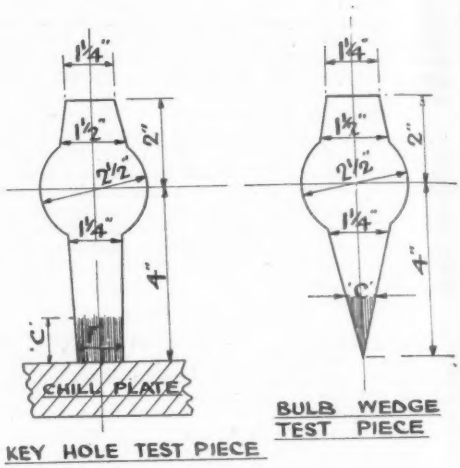


FIG. 15.—THE ALTERNATIVE TEST PIECES INDICATE CHILL AND THE STRUCTURE OF THICK SECTIONS.

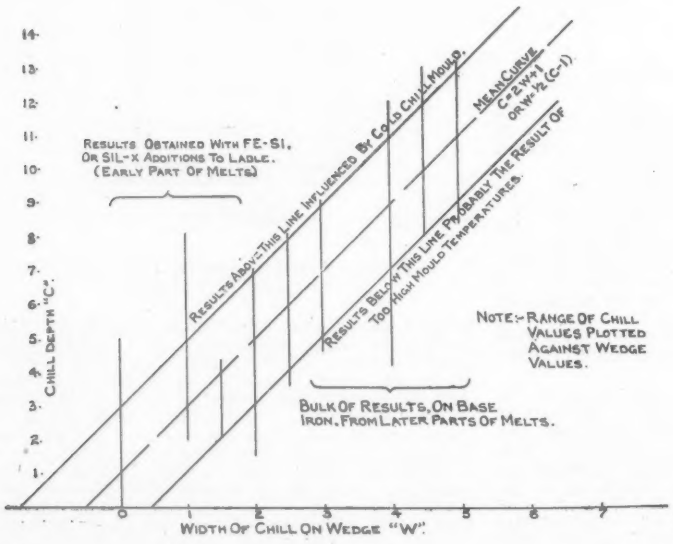

CHILL DEPTH "C".
WIDTH OF CHILL ON WEDGE "W".
RESULTS OBTAINED WITH FE-SI, OR SIL-X ADDITIONS TO LADLE. (EARLY PART OF MELTS)
RESULTS ABOVE THIS LINE INFLUENCED BY COLD CHILL MOULD.
MEAN CURVE C=2W+1 OR W=½(C-1)
RESULTS BELOW THIS LINE PROBABLY THE RESULT OF TOO HIGH MOULD TEMPERATURES.
NOTE:- RANGE OF CHILL VALUES PLOTTED AGAINST WEDGE VALUES.
BULK OF RESULTS, ON BASE IRON, FROM LATER PARTS OF MELTS.

FIG. 16.—CORRELATION OF WEDGE AND CHILL TESTS (COVERING 10 TESTS).

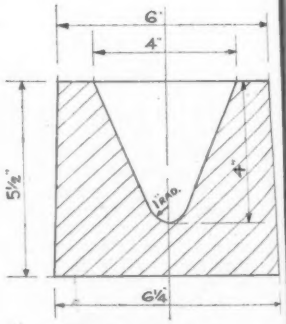


FIG. 17.—CAST IRON CHILL MOULD CORE AND PYRAMID.

bars are cast they are placed on their respective positions on the pattern board with the same chills in position. The shrinkage is then measured by micrometer or by means of a tapered measuring gauge which is passed between the ends of the bars and their chills.

Shrinkage as measured by these tests is affected chiefly by differences in carbon and silicon contents. Each founder must establish a standard shrinkage for the test-bars used or a master curve which is found to produce the best castings he has to manufacture. All routine tests should be compared with the standard and corrections of metal mix made as necessary.

Apart from variations in shrinkage arising from differences in metal composition, the founder is often confronted with problems due to solidification, *e.g.*, porosity, coarse structure and draws, which are due to the effects of shrinkage. Test-pieces which will indicate the tendency of metal to show internal porosity are therefore valuable. Such test-bars are the "K" bar and the "T" bar illustrated in Figs. 19 and 20. The moulds for these bars should be made in oil sand so as to maintain uniform conditions.

The "K" test-bar. The "K" bar originally developed by Cook has been of particular value for experimental purposes and as a check test for large castings. Modifications to its design have been made by various users from time to time to suit the particular class of metal or type of casting which they produce. The design shown in Fig. 19 is typical of one in current use on light engineering castings. The bar is cast from a sampling ladle and when cool is fractured through the centre of the junction of the arms. The fracture may then reveal porosity, coarse structure or normal structure according to the characteristics of the molten metal. The time necessary for carrying out the "K" bar test varies from 10 to 15 minutes.

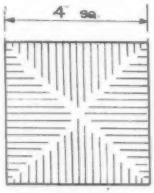


FIG. 18.—PLAN OF PYRAMID BLOCK TEST.

The "T" test bar. The "T" bar is considered to be more effective than the "K" bar in producing a pronounced "hot spot" which shows porosity with metal which might be sound in the "K" bar test. The "T" bar is also made in an oil sand mould with ingate at end A, or alternatively, the bar may be cast vertically with end B uppermost and forming an open runner. This latter method has the advantage of indicating "the sink" which takes place in the head; it is, however, necessary to ensure that the head is completely filled with molten metal when pouring. The bar is fractured as indicated and any porosity which may be revealed is measured by comparative observation. The time necessary to complete such a test is 15-20 minutes.

(c) FLUIDITY TESTS

Fluidity has been defined as "the property that metals have of flowing freely and so of filling readily the cavity of a mould." Fluidity tests which can be carried out and results obtained in less than two minutes will give a good indication whether the metal is suitable for any particular casting or type of casting. Poor fluidity is one of the reasons for edges of castings being rounded and chilled instead of being sharp and machineable, or in some cases excessively high fluidity can cause burnt-on sand, sinking and metal penetration (Fig. 21).

Carbon and phosphorus contents, metal temperature,

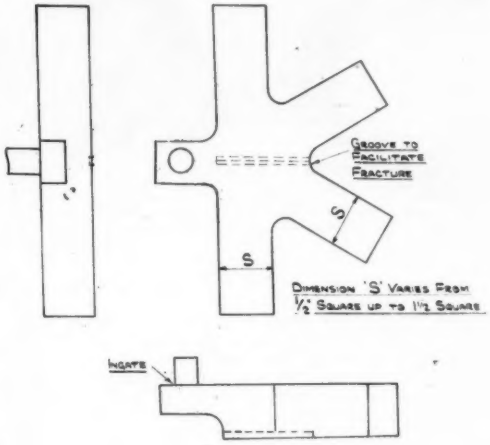


FIG. 19.—"K" BAR TYPE OF TEST.

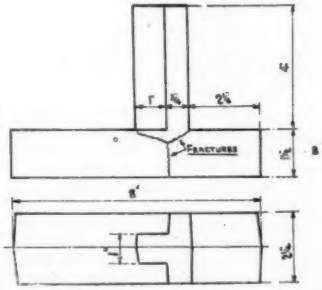


FIG. 20.—"T" BAR TYPE OF TEST.

Control Tests for Grey Cast Iron

presence of oxide skin, viscosity and surface tension all have an effect on metal fluidity and make it necessary for the foundryman to decide which particular test-piece he will adopt for use in his own foundry.

of different diameters are provided in the mould in order to facilitate the reading of results from irons the characteristics of which will vary with the type of casting being produced. Thus for metal suitable for light, thin-sectioned castings the smallest would be used while the medium or largest limbs would give more readable results with metal suitable for heavier

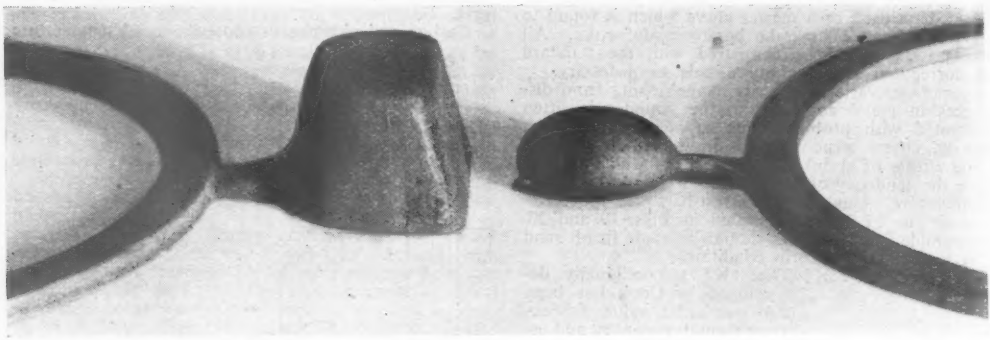


FIG. 21.—DEFECTS DUE TO FLUIDITY.

The most important effect is exercised by metal temperature and it is important in all cases to record the temperature at which the test piece is cast. For instance, in the case of light, thin-sectioned castings an increase in total carbon above the eutectic point causing deposition of free graphite, can have as bad an effect on fluidity as a temperature drop. Various means of temperature measurement are discussed in Appendix A. The importance of standardised test conditions cannot be too strongly emphasised. Sand composition and condition, moulding practice, metal head pressure, pouring technique and runner dimensions should be standardised.

Types of Test. The three principal types of test are: (1) the U-type, (2) the Ruff and (3) the spiral, and of these the Sub-Committee recommend the U-type as being of most general application, although conditions may arise which make the use of the Ruff or spiral test desirable. If the spiral test be chosen, then the Sub-Committee recommend the design which is run from the outside through a horn gate runner and without risers. (Figs. 25 and 26).

The U-Type test-piece. One of the principal reasons for recommending the U-type test (Fig. 22) is that many of the variable factors such as moulding technique, sand condition and running arrangements are overcome by the adoption of a chill mould. The cast iron mould is constructed in two parts which may be hinged at one end and clamped at the other or otherwise arranged for accurate and speedy opening and closure.

The test is conducted by pouring the metal into the runner dish until it runs level in the "riser" and then measuring the length in mm. of the offshoot or "fluidity limb." It will be noted that three "fluidity limbs"

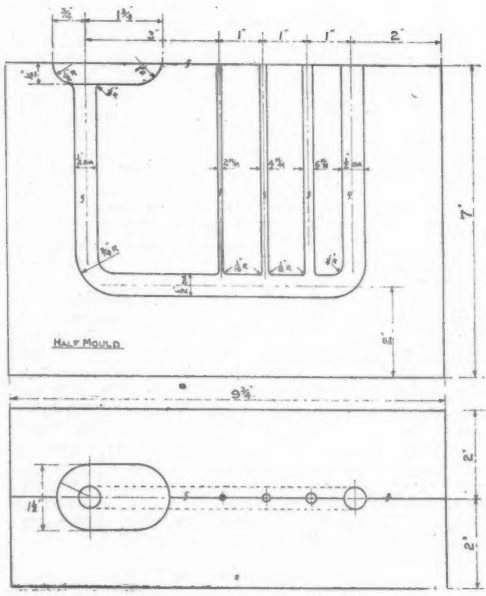


FIG. 22.—THE "U" FLUIDITY TEST MOULD.

work. The measured length of the fluidity limb in mm. is termed the fluidity number which may be expressed as, for example, "U fluidity 12 mm. A, B or C" according to the limb used; A being the smallest limb.

The tests may be made with great rapidity; one series of 21 tests was cast in 49 minutes by a member of the Sub-Committee for the purpose of ascertaining whether mould temperature affected the results

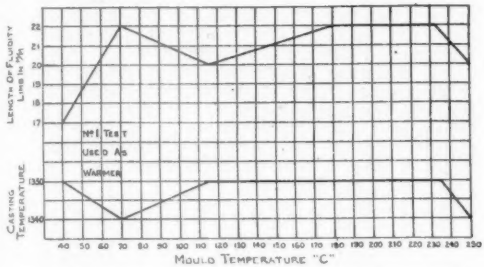


FIG. 23.—RATIO BETWEEN LENGTH OF SPIRAL AND MOULD TEMPERATURE.

obtained. It was found from this experiment that no apparent increase in fluidity is caused by mould temperatures up to 250 deg. C. and that the mould heats very rapidly to approximately 200 deg. C. and then more slowly to 300 deg. C. which is the maximum temperature which can be expected under normal casting conditions. The results of this test are shown graphically in Fig. 23.

The Ruff Test. The Ruff fluidity test is shown in Fig. 24 and consists of a straight round bar, the pattern for which may be withdrawn through the side of the corebox, and the boss which may be withdrawn through the top. The core and bush which are cheap and

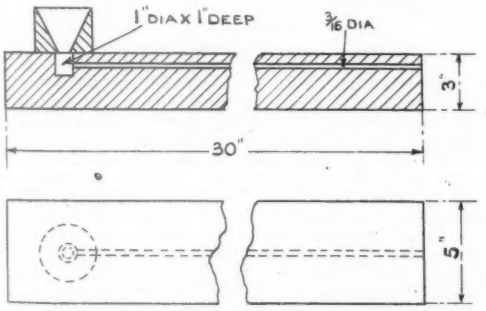


FIG. 24.—RUFF TYPE OF FLUIDITY TEST.

simple to make should be in oil sand to minimise variation in the resistance to flow and the grade of sea sand used should be stated when reporting results. As in the case of the U-test three sizes of bar (which can be made interchangeable in the box) may be used, A (2 mm. dia), B (4 mm. dia.) and C (6 mm. dia.), and the results may be reported as for example "Ruff fluidity 12 mm. A, B or C" according to the size used. A stock of test moulds may be stored and handled with ease.

(To be continued.)

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

DEFINING SOME FOUNDRY TERMS

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—May I refer to the interesting article entitled "Defining Some Foundry Terms" in your issue dated July 4? Whilst it may not be considered the responsibility of engineers, draughtsmen, etc., to produce sound castings, it must be apparent that a better understanding of foundry terms would assist them in carrying out their respective functions, thereby rendering no little assistance to the practical man to overcome many of his difficulties.

One point which your correspondent omits to stress is the glib way in which foundrymen are apt to use their own terms during discussions with engineers, draughtsmen, etc. In fact, it is this loose general manner which is largely responsible for the foundryman being somewhat despised and treated as a Cinderella by other branches of engineering. In my opinion, foundry work is one of the most difficult branches of engineering and calls for the highest degree of knowledge. As foundrymen, it is up to us to do all we can to encourage the young student.

The terms quoted in the article are largely duplications, being representative of varying degrees of defect. I agree wholeheartedly with the author's statement that a glossary of terms is long overdue. In these changing days I would suggest that the time is now opportune for the foundry trade to fall into line with other branches of engineering by establishing recognised standards for the guidance of new entrants and students.

Surely it is up to the Institute of British Foundrymen to give the lead by appointing a sub-committee to investigate the matter, and ultimately establish and issue a glossary; in fact, I go so far as to say establish and issue a standard official code of practice.

Yours, etc.,
G. A. HARVEY.

147, Nevill Road,
Hove, 4.
July 10, 1946.

THE NICKEL BULLETIN for May, 1946, contains abstracts covering the polarographic analysis of nickel compounds, hard magnetic materials, glass-to-metal seals, the overheating of steel, the creep properties of Monel and Inconel, and the uses of nickel and nickel alloy in the pulp and paper industry. Copies of the Nickel Bulletin may be obtained from The Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

SOURCES OF HYDROGEN IN CAST IRON

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Mr. W. T. Buchanan's letter on the subject of my recent article on "Sources of Hydrogen in Cast Iron" has the merit of being a normal approach to the subject. The matter having been raised, I may perhaps refer to a possible theory I have evolved to explain the facts to which my article was limited.

There is no reference or intimation in my article to the method of moisture determination or to the use of small powdered samples of coke, and, indeed, if Mr. Buchanan will refer to the work of the coke research committees, he will find recommended the "partial" and rapid breaking of the coke to walnut size and less, and the use of a large sample and special oven for primary moisture test owing to the time consumed and loss of moisture in preparing a small powdered sample. After the primary moisture determination the whole sample is then crushed, halved and quartered, crushed finer, etc., until the small laboratory powdered sample is obtained. This is dried in the laboratory at 110 deg. C., and then used. In practice there is rarely more than 0.1 per cent. moisture in the powdered sample.

It is also not necessary to determine moisture accurately, *i.e.*, to several places of decimals, and the author used a tin containing 12 lb. 8 ozs. (200 ozs.) of walnut-sized coke and dried this to constant weight in a core stove. The error was certainly less than 0.2 per cent. moisture as judged from laboratory tests and the time consumed very small indeed. The samples were taken either just before or while the pile of coke was being used.

Mr. Buchanan has advanced the "opinion" that under cupola conditions all moisture is removed from coke at 12 in. below the sill. This is probably roughly true, but Mr. Buchanan forgets that in my article it is discreetly intimated that the use of sheeted wagons proved that moisture was introduced during quenching at the ovens and was therefore internal (sucked in) and not just surface moisture due to rain. Because of the repeated variation of the number of eruptive defects with coke moisture and no other factor (*including* moisture in the air) the theory was evolved that although surface moisture is removed quickly, as Mr. Buchanan, and, indeed, commonsense dictates, above a certain moisture content (due to the absorbtion during quenching), some of the internal moisture in almost completely sealed pores is merely vaporised by the heat and only that excess above atmospheric pressure removed whilst the remainder stays in the pore until the coke burns—reacts with the steam to give $H_2 + CO$.

The molten receptive metal, already partially saturated with hydrogen from the original content of the raw materials plus the moisture in the air blown in through the tuyeres, is trickling down over the burning coke. The hydrogen under this condition may even be nascent at the moment of solution, and so more easily absorbed, although the author prefers the explanation that blast moisture is decomposed at the tuyeres (or thereabouts) in an oxidising atmosphere, and so the "nascent" hydrogen from blast moisture must penetrate an oxide film before dissolving in the metal droplets, whereas, at the melting zone, conditions are much more reducing and oxide films either non-existent or much thinner.

The author asks Mr. Buchanan to believe that his reference to Mr. Buchanan's cast-iron bell method as "unsuitable" was in no way an attack on the method, but, under the author's melting conditions, the total gas evolved was too small to enable Mr. Buchanan's technique to be applied.

Mr. Buchanan is quite correct in calling attention to the oxygen found in the author's samples and as the apparatus was home-made, with rather old pressure tubing, it is just possible that slight mixture with air occurred during suction of the sample from the sampling tube. This does not affect the result for "ml. hydrogen," however.

Mr. Buchanan is quite wrong in assuming that there is no advantage in being able to machine a vacuum fusion test-piece out of the residual plug. It is extremely probable that it is the *total* hydrogen in the molten metal that causes defects and structural changes and so residual and evolved hydrogen must be measured. As the author says in his article, "It may be the influence of hydrogen in ordinary foundry practice is very small, but until it is (all) measured, who can tell?"

In conclusion, the author would like to state that, in his opinion ,the great advantage of Hatfield and Newell's method, over Buchanan's, is that the gas is evolved in an atmosphere of nitrogen and thus no further re-action with atmospheric oxygen can alter the ratios of the gases, *i.e.*, $H_2 + O \rightarrow H_2 \rightarrow$ water, and so being lost. Incidentally, the metal was a normal grey cast iron to 4.K.6 specification.

Yours, etc.,
R. C. TUCKER.

Halesowen,
July 2, 1946.

F.B.I. MISSION TO BRUSSELS

An F.B.I. delegation, on the invitation of the Federation of Belgian Industries, is in Brussels to continue discussions begun in January last when representative Belgian industrialists visited England.

The British delegation (under the leadership of Lt.-Col. Lord Dudley Gordon, D.S.O., past-president of the F.B.I.) consists of:—Mr. A. W. Berry (British Engineers' Association), Mr. F. Bower (Lever Bros. & Unilever, Limited), Mr. D. M. Buist (British Electrical & Allied Manufacturers' Association), Mr. J. Clay (Wool Export Group), Mr. R. Colin Smith (British Iron & Steel Federation), Mr. H. J. Kingsbury (Society of Motor Manufacturers & Traders, Limited), Sir Guy Locock, C.M.G. (vice-president and former director of the F.B.I.), Mr. L. P. O'Brien (Association of British Chemical Manufacturers), Mr. S. E. D. Wilson (Mining Association of Great Britain), and Mr. R. C. G. Hunt-Taylor, secretary to the delegation (F.B.I.).

METAL-FACED PATTERN EQUIPMENT*

By A. N. WHIPP

Introduction

In the foundry with which the Author is associated, it was essential, during the war period, to maintain a very rigid inspection of all pattern equipment and to use patterns with a guaranteed accuracy and durability capable of producing many thousands of castings. The foundry manufactured castings for armoured fighting vehicles and armoured cars, as well as castings for the Admiralty and Air Ministry, and the Author often had to decide what type and quality of pattern equipment was needed to produce the required castings and to give the least possible trouble during production. In most cases, the solution was found in patterns made of cast iron, brass, phosphor bronze or aluminium, with core boxes of cast iron or mild steel. The large quantities and, in some cases, the Government priority of the work, made possible the expenditure of money on first-class working equipment.

For post-war production the industry is faced with the problem of executing orders which call for smaller quantities, when the additional cost of all metal equipment will not be practicable. Therefore the hard wood patterns, chiefly mahogany, must be constructed so as to withstand the hard knocks of the peg-rammer, venting rod, core-blowing machine, Sandslinger, machine jolting, and the transportation between pattern stores and foundry. No matter how carefully hard wood equipment is handled, it is not very long before the moulder is having to use a file on the edges of the cores to enable them to seat correctly in the mould, because a corner has been knocked off a core print or a radius has worn on the square edge.

Similarly, complaints come from the castings inspector or the machine shop, of castings coming undersize on the edge of machined faces, pads and bosses, and unnecessary welding has to be carried out to maintain the required dimensions. Correctly constructed metal-faced mahogany equipment will stand up to this unavoidable damage to exposed faces, but it is the pattern-maker's duty to visualise from the commencement of his particular job which parts are likely to be eroded during service in the foundry or core shop, and make the necessary allowance during construction for metal facings or small solid metal webs and bosses. If this is left until the patterns and core boxes are in use and the erosion of vulnerable points is causing unnecessary welding and core filling, then he will have to use his most valuable tools on timber which is pitted and scarred with sand.

Serviceable Metals for Facing

Sheet brass has proved to be the most serviceable metal for facings, with mild steel a very good substitute. Aluminium is too soft and easily damaged. The brass should be $\frac{3}{32}$ in. to $\frac{1}{4}$ in. thick, as this is easy to cut and file to the required shape and the soldering of countersunk screw holes easily carried out.

Parts to be Faced.—Owing to the various types and designs of pattern equipment handled in the master pattern shop, it is impossible to give a general ruling on the parts which should be metal faced. For example, to state that all bosses should be faced would be incorrect, because the pattern may be constructed in such a manner that some bosses are in a position to escape the rammer. Similarly, webs and flanges in a core box may be in a horizontal position and carry a radius on the corners. Thus any wear due to sand will not be detrimental to the castings.

When visualising any pattern in the moulding box, one can say with certainty that all vertical walls are quite safe from the peg-rammer and Sandslinger, but may receive slight scratches from the venting rod. This also applies to the vertical faces of core boxes and core prints, so they do not need facing.

The sharp edges and corners and the top faces of all horizontal bosses, pads, machined flanges and core prints must be considered individually. A boss, if it is shallow, such as that required for spot facing or to take a shallow tapped hole, can be made of solid metal with the fillet attached, but if it is a deep boss, the face should be covered completely with a brass disc. If the boss is required on a perpendicular face of the pattern, the uppermost half should be faced to safeguard the sharp edge of the boss.

In the case of a vertical flange as required on such castings as a worm casing or axle casing for heavy motor vehicles, or on the large valve bodies and covers for high pressure pumps, it is always the outside rim and not the face of the flange which is damaged most. Therefore, this edge should be covered by a metal strip of the same width as the flange thickness, care being taken to maintain the correct diameter or profile shown on the drawing.

Vulnerable Points

Many pattern designs call for machined or unmachined horizontal pads and faces with square edges, and most core prints have a flat top face with sharp corners and square edges. All these are vulnerable points, and must be protected by metal. If the top faces of pads or core prints are very small in area, they can be covered completely, but for larger areas a narrow strip of brass approx. $\frac{1}{4}$ in. wide inlaid along the exposed edges and mitred at the corners is sufficient.

Thin webs often get damaged and give considerable trouble by breaking the mould or core during stripping. They generally split when repaired hastily and have to be renewed. If webs are less than $\frac{1}{4}$ in. thick and have no side support, they should be cast in brass with fillets and fixing lugs attached.

The foundry supervisor often finds it necessary to use chills to prevent casting discrepancies, the chills being placed on the surface of the pattern or in the core box. These soon cut into the woodwork, with the result that a deep impression is seen on the casting face. To prevent this, a metal plate, slightly larger

... (*Continued overleaf, column* 2.)

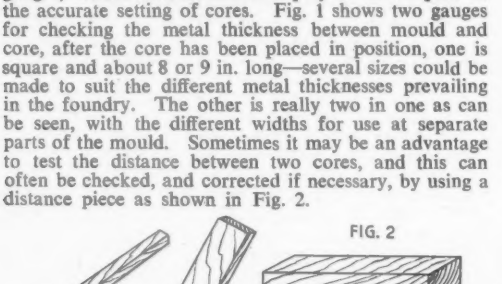
* Prize-winning entry for a short Paper competition organised by the London branch of the Institute of British Foundrymen. The Author is on the staff of Lake & Elliot, Limited.

GAUGES FOR MOULDS AND CORES

By "CHECKER"

Gauges have been used in increasing numbers for moulds and cores during the last few years, and have amply repaid the foundries for the time and cost of producing them. The shape and size of any gauges are governed by the job in hand, but it should always be the rule to make every gauge as simple and easy to use as possible.

The following are some of the less complicated gauges, which nevertheless can play a useful part in the accurate setting of cores. Fig. 1 shows two gauges for checking the metal thickness between mould and core, after the core has been placed in position, one is square and about 8 or 9 in. long—several sizes could be made to suit the different metal thicknesses prevailing in the foundry. The other is really two in one as can be seen, with the different widths for use at separate parts of the mould. Sometimes it may be an advantage to test the distance between two cores, and this can often be checked, and corrected if necessary, by using a distance piece as shown in Fig. 2.



Those shown in Figs. 1 and 2 can be made out of wood at very little cost, but if the two gauges shown in Fig. 3 are made out of wood, it is advisable to use a plywood about ⅛ to ¼ in. in thickness, to eliminate twisting, and to get extra strength. One of these is used to check the round ends of cores which are made in halves and gummed together, and as will be noticed, two sizes are cut out on one gauge for convenience. The important part on these gauges is not the radius, but the flat pieces extending for approximately ¼ in., which act as a pair of calipers permanently set to the required core size. The other gauge is of the bridge type, and can be used to check cores for height off a flat surface before going to the mould, or a similar pattern can also be used in the mould to try the height of a core which has been placed in position.

Should it be advisable to make the last two gauges mentioned in metal, the caliper type of gauge could be made out of ⅛ in. mild steel, while the bridge type could

(*Continued at foot of next column.*)

METAL-FACED PATTERN EQUIPMENT

(*Continued from previous page.*)

than the required chill, must be let into the pattern, and, when a radius has to be maintained, a cast metal strip or ring carrying the radii inlaid to give a seating for the round chill.

When dealing with all core boxes it is found that the top face or the joint face, if the core is made in halves, receives very severe punishment, especially from the core-blowing machine. For a small box the exposed face must be covered completely. For a larger box ¼-in. strips of metal may be cut to the profile of the core and inserted flush with the surface of the box. For coring out the centre bore of a hub casting or axle casing, the boxes often have the ball-race seating and the boss for the oiling nipple in relief. Whichever way the core is made, these points are exposed to the peg-rammer, and must be protected by a metal facing or by a casting fitted in the core box if the seating is narrow.

Correct Fixing

The value of the metal-faced pattern equipment is lost if great care be not taken when fixing the metal in position. If this point be neglected, it will be found that the continual jolting and rapping of patterns and core boxes has caused either the metal pieces to work loose and overlap the woodwork, or the solder in the countersunk screw holes to fall out, and much damage is caused when stripping. Screws should always be used for fixing. They should be sufficient in number to prevent the metal lifting, the screw holes being countersunk just enough to allow the screw head to be flush with the surface of the metal facing, leaving only the screw head slot to fill with solder. If this small piece of solder falls out very little damage is caused.

A good example of the durability of the metal-faced mahogany equipment is shown by the following data taken from the despatch records:—

Pattern Description.	*Castings Supplied.*
328 mm. brake drums for heavy motor vehicles ...	1,700 iron castings over a 2-yr. period.
Large worm casing for heavy motor vehicles ...	1,800 iron castings over a 2-yr. period.
Small worm casing for heavy motor vehicles ...	700 iron castings over a 10-month period.
Rear axle casing for heavy motor vehicles ...	1,200 steel castings over a 9-month period.
Suspension unit for heavy tanks	1,800 steel castings over a 1-yr. period.
Large magnet frames for electric motors	500 steel castings over a 1-yr. period.

(*Continued from previous column.*)

be made out of similar material, but would require a thicker portion fastening on to act as feet, to give the required balance as shown in Fig. 4. Whenever possible a small hole should be drilled in the gauges, so that they can be hung on nails in convenient positions, or when not in use can be kept together by means of a piece of core wire through the holes.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

576,275 HIGH DUTY ALLOYS, LIMITED, HANSTOCK, R. F., and MURRAY, A. Apparatus for exciting or detecting torsional oscillations in elastic bodies.

576,313 CARNEGIE-ILLINOIS STEEL CORPORATION. Continuous metal strip electrolytic tinning lines.

576,331 MCDONALD, J., FINLAYSON, A., and G. W. B. ELECTRIC FURNACES, LIMITED. Furnaces.

576,390 CANNING & COMPANY, LIMITED, W., and POPE, G. A. Electroplating apparatus.

576,429 PARSONS CHAIN COMPANY, LIMITED, and CARRINGTON, G. F. Heat-treatment of chains.

576,450 JENKINS, A. Milling machine for use in die-sinking.

576,504 SCOTT, F. P. D., and PRIOR STOKERS, LIMITED. Grates or burners for boilers and the like.

576,525 ENGLISH ELECTRIC COMPANY, LIMITED, CHADWICK, G., and SALTHOUSE, J. E. Cooling of electrodes.

576,583 LOEWY ENGINEERING COMPANY, LIMITED, and FERNBACH, H. R. Electrical drives for rotary shears.

576,642 PARFITT, A. W. (Canadian Refractories, Limited). Basic refractory materials.

576,675 CRITTALL MANUFACTURING COMPANY, LIMITED, and CRITTALL, W. F. Aluminium and other light-material windows.

576,699 PLASCO, LIMITED (Spool Cotton Company). Method of and apparatus for forming inter-coupled die-castings.

576,742 HOOVER, W. S. Centrifugally cast propeller blades.

576,761 FOX, G. W., and UNITED STEEL COMPANIES, LIMITED. Rolls of rolling mills.

576,769 WROUGHT LIGHT ALLOYS DEVELOPMENT ASSOCIATION, and WEST, E. G. Welding of aluminium or aluminium alloys.

576,799 SARGINSON, R. H. Production of core driers for foundry purposes.

576,817 EQUIPMENT & ENGINEERING COMPANY, LIMITED, and SWIFT, H. B. Magnetising devices for the detection of cracks.

576,853 GIBBONS BROS., LIMITED, MARLE, M. VAN., and WEBB, A. W. OGILVY-. Furnaces.

576,860 BIRLEC, LIMITED, and HANCOCK, P. F. Rotary carburising furnaces.

576,875 CALLENDER-SUCHY DEVELOPMENTS, LIMITED, and SUCHY, C. T. Electro-deposition of metal on non-conductive material.

576,906 NATIONAL SMELTING COMPANY, LIMITED, MORGAN, S. W. K., WOODS, S. E., and DERHAM, L. J. Production of zinc.

576,932 AKT.-GES. BROWN, BOVERI & CIE. Method of and means for separating slag from furnace gases.

577,061 GIBBONS BROS., LIMITED, and MARLE, M. VAN. Furnaces particularly applicable for the heat-treatment of metal.

577,065 BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION, LIDDIARD, E. A. G., and MAY, R. Alloy.

577,067 SUTTON, H., THOMPSON, J., and BRIMELOW, E. I. Aluminium-rich alloys.

OBITUARY

MR. JAMES WINK, late manager of the Aberdeen branch of the General Electric Company, Limited, died on July 5.

MR. THOMAS HENDERSON, a director of W. B. Henderson, Limited, Canal Steel and File Works, Falkirk, died recently.

MR. N. G. BLYTH, chief draughtsman with Bartram & Sons, Limited, shipbuilders and repairers, of Sunderland, has died at the age of 34. He took up the appointment only three months ago.

MR. ASA BINNS, formerly chief engineer to the Port of London Authority, died recently, aged 72. In 1896 he was awarded a Whitworth exhibition. He was president of the Institution of Engineers-in-Charge in 1936-37, a member of the Council of the Institution of Civil Engineers, and a past-president of the Institution of Mechanical Engineers.

SIR WALTER REUBEN PRESTON died suddenly from heart failure on board his yacht at Cowes, on July 6; he was 70 years of age. Sir Walter was, until a month ago, chairman of Platt Bros. & Company (Holdings), Limited, and Platt Bros. & Company, Limited, president of Textile Machinery Makers, Limited, and a director of the Midland Bank, Limited, Tweedales & Smalley (1920), Limited, J. Stone & Company, Limited, and other companies. His recent retirement was on medical advice. He sat as a Conservative member in the House of Commons for some years.

CODE OF PRACTICE IN FAN MANUFACTURE

A proposal to introduce a standard code of practice in fan manufacture was made at the second annual general meeting of the Fan and Allied Manufacturers' Association held in London on July 4. The meeting, in approving the motion, agreed that membership of the Association should be conditional on adherence to the code of practice. Members also agreed to adopt standard conditions of sale.

Mr. Geoffrey Woods, of Woods of Colchester, Limited, was unanimously re-elected chairman for the third successive year.

PERSONAL

MR. H. M. BARTON has retired from the board of Wales, Limited, manufacturers of metal bedsteads, etc., of Birmingham.

CAPT. SIR JOHN FISHER and MR. J. K. VAUGHAN-MORGAN have been appointed directors of the Barrow Hematite Steel Company, Limited.

MR. JOSEPH HARLEY, office manager at the Hallside Works of the Steel Company of Scotland, Limited, has retired after 52 years' service with the firm.

MR. DENIS REBBECK, a director of Harland & Wolff, Limited, shipbuilders, etc., of Belfast, has received the degree of B.Litt., by thesis, at Trinity College, Dublin.

MR. J. W. LAST has retired after completing 55 years in the foundry sales department of the Staveley Coal & Iron Company, Limited. He was presented with a wallet of notes.

MR. EDGAR PRESTWICH, a director of J. C. Prestwich, Limited, manufacturers of bolts, nuts, rivets, etc., of Atherton, Lancs, is among the new Justices of the Peace for the County Palatine of Lancaster.

COL. B. H. LEESON, managing director of A. Reyrolle & Company, Limited, manufacturing electrical engineers, Hebburn-on-Tyne, has been appointed a director of the Consett Iron Company, Limited.

MR. M. SEAMAN and MR. J. F. B. JACKSON have been appointed to the board of P. R. Jackson & Company, Limited, engineers and founders, etc., of Manchester, a subsidiary of David Brown & Sons (Huddersfield), Limited.

MR. HUGH WARREN, managing director of the British Thomson-Houston Company, Limited, and formerly director of the company's research and engineering, has received the degree of Doctor of Science, Honoris Causa, at Birmingham University.

MR. R. A. HACKING has resigned his position as a special director of Dorman, Long & Company, Limited, and has been appointed by Richard Thomas & Baldwins, Limited, to deal with, and advise on, all that company's iron and steel production, including new construction and development.

PROF. RONALD N. ARNOLD, Professor of Engineering at the University College of Swansea, has been appointed to the Regius Chair of Engineering in the University of Edinburgh, which has been vacant since the death of Sir Thomas Hudson Beare. Prof. Arnold served his engineering apprenticeship in Glasgow.

DR. L. N. BRAMLEY has been appointed electrical engineer to the plant engineering division of the British Iron and Steel Research Association, where he will be working on problems associated with electrical equipment of steelworks plant generally, including power follow-up gear, such as is found in steelworks cranes. Dr. Bramley received his training as an electrical engineer at the City and Guilds Engineering College and, following a year's post-graduate research work there, joined the research laboratories of W. T. Henley's Telegraph Works Company, Limited. In 1937 he took up an appointment at the Royal Aircraft Establishment at Farnborough and recently relinquished his position there as head of the electrical instrumentation section of the chemistry division.

Wills

LLOYD, H. D. L., of Warrington, wire manufacturer...	£48,077
EVERITT, C. K., chairman of Edgar Allen & Company, Limited, steelmakers, founders, etc., of Sheffield	£34,401

IN PARLIAMENT

Government-owned Steelworks

MR. LANGFORD-HOLT asked the Minister of Supply (1) what was the total amount of capital moneys invested by H.M. Government, including both purchase price and subsequent capital expenditure, in the Government-owned steelworks at Monkbridge, Leeds, and Barrow-in-Furness; and (2) if he would publish the trading results of the Government-owned steelworks at Monkbridge, Leeds, and Barrow-in-Furness up to March 31, 1946.

MR. WILMOT circulated his reply in the "Official Report," stating that the total capital expenditure was £724,000 at the Barrow works and £522,000 at the Monkbridge works. It was contrary to normal practice to publish the trading results of the individual factories operated by his Department. He could, however, state that the operation of the Barrow works resulted in a net loss of £779,000 from November 1, 1942, to March 31, 1946, and of the Monkbridge works in a net loss of £180,000 from August 10, 1942, to March 31, 1946. Production from these two works was needed for national requirements, but they were uneconomic producers and would not normally have been kept in operation. The Government, therefore, acquired ownership in order to maintain production. The output following acquisition had been satisfactory and the trading losses sustained had been less than would have been the cost of importing an equivalent quantity of steel, even if supplies could have been made available and shipped.

Lead Sheets and Pipes for Housing

MAJOR LLOYD asked the Minister of Supply what tonnage of pig-lead had been released for the manufacture of sheets and pipes for housing during the first quarter of the present year, and the tonnage used for this purpose in 1936 to 1938.

MR. LEONARD, in reply, said that the quantity of lead used for the manufacture of sheets and pipes in the first quarter of this year was 23,000 tons. The quantity used for this purpose in 1936, 1937 and 1938 was 180,000, 180,000 and 170,000 tons per annum respectively. In each case the figures included sheets and pipes manufactured for industrial installations (chemical plants, etc.), but the greater bulk would be for housing.

AN "ON-SITE" SALE of surplus machine tools will be opened by the Ministry of Supply at the Rolls-Royce factory at Hillington, Glasgow, on July 31.

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Manufactured to guaranteed analyses in seven standard grades. Also obtainable to individual specification

THE 17-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON

1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit

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NEWS IN BRIEF

HUNTINGTON, HEBERLEIN & COMPANY, LIMITED, 114, Cromwell Road, London, S.W.7, have received an order for a complete sintering unit from Dorman, Long & Company, Limited.

THE NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD have placed contracts of a total value of £163,000 with Bruce Peebles & Company, Limited, Edinburgh, for electrical plant and machinery for generating stations.

THREE ADDITIONAL SELLING CENTRES for Government surplus machine tools will be opened by the Ministry of Supply on July 23 at Elstow, Kempston Hardwick, Bedford, Capenhurst, near Chester, and Saltney Ferry, near Chester.

THE ANNUAL MEETING of the British Association for the Advancement of Science will be held on Saturday at the British Medical Association, Tavistock Square, London. Sir Richard Gregory will deliver the presidential address.

B. ELLIOTT & COMPANY, LIMITED, manufacturers and merchants of milling, shaping, drilling and grinding machines and other engineering equipment, have received permission to deal in the whole of the 900,000 ordinary 1s. shares.

TO DATE, iron ore imported to the Tyne is nearly 20 per cent. above that for the corresponding period of last year. Recently a Swedish ship discharged a record cargo of 11,566 tons at Tyne Dock, the largest single cargo of iron ore handled at the dock.

THE ANNUAL REPORT of J. Stone & Company, Limited, engineers and non-ferrous founders, of Deptford, London, S.E.14, states that cancellations of war contracts adversely affected output, but that substantial orders have since been received and the works should be fully employed for the next 12 months.

THE THIRD ANNUAL VISIT of members of the British Cast Iron Research Association to the Association's headquarters at Alvechurch, near Birmingham, attracted some 150 members on July 10, when the visitors had the option of inspecting the various departments either in conducted parties or independently.

JOHN LYSAGHT, LIMITED, iron and steel makers, etc., of Newport, Mon., and elsewhere, have arranged five schemes covering apprenticeships in electrical and mechanical engineering (trade and student), research and development, works management and commerce, which are designed to link up with education received up to school-leaving age.

SHAREHOLDERS OF John I. Thornycroft & Company, Limited, engineers, shipbuilders, founders, etc., have been asked by the board to adopt a new set of Articles in order to bring the company into line with present-day practice. A new Article appoints Sir John Thornycroft life governing director and chairman. This appointment is subject to a provision that all directors retire at the age of 75, though they may be re-elected by a special resolution. Extra-ordinary general meetings to vote on the new Articles will be held on July 30.

CAPT. LESLIE GAMAGE, president of the Institute of Export, speaking at a luncheon given by the Manchester and District branch, said he was afraid that many people at present were living in a fool's paradise, particularly in regard to the export trade. With the overseas markets largely to ourselves, what had we achieved? For one month only had we reached the pre-war volume of exports, whereas our minimum target was the pre-war volume plus 100 per cent. Industry was doing its best, but there was nothing like an adequate supply of labour.

OVER 200 WORKERS were the guests of the management of Matthew Swain, Limited, Railway Foundry, Newton Heath, Manchester, at a Victory excursion to Blackpool on July 6. A sports meeting was held in the morning after which lunch was served at the Baronial Hall, Winter Gardens. The chairman of the company, Mr. J. Swain, handed to Mr. J. W. Churm, a moulder, a gold watch and cheque to commemorate his completion of 50 years' service with the firm. Mr. Churm also received a fifth bar to his gold medal, and a Westminster chimes clock from his workmates.

COMPANY RESULTS

(Figures for previous year in brackets.)

British Timken—Dividend of 15% (same).

Sheffield Steel Products—Dividend of 7½% (same).

Beans Industries—Interim dividend of 10% (same).

Harland Engineering Company—Net profit for 1945, £17,296 (£16,678); dividend of 7% (same); forward, £16,002 (£14,800).

Armstrong Siddeley Development Company—Net profit for the year ended July 31 last, £474,579 (£475,079); dividend of 28½% (same); forward, £125,328 (£110,749).

Whitehead Iron & Steel Company—Net profit for the year ended March 31, £220,852 (£160,137); final dividend of 10%, making 20% (same); forward, £194,466 (£131,116).

J. Stone & Company—Net profit for 1945, after crediting £28,000 (nil) E.P.T. recovery, £228,155 (£224,114); final dividend of 15%, making 25% (same); forward, £342,715 £353,660).

Gjers, Mills & Company—Profit for 1945, £75,138 (£104,508); to tax and N.D.C., £37,500 (£54,500); deferred repairs and contingencies, £13,000 (£7,000); dividend of 12½% (same); forward, £41,667 £41,254).

A.B.C. Coupler & Engineering Company—Net profit for the year ended September 30, £6,694 (£6,534); to general reserve, £3,433 (£4,000); dividend of 15% (same), plus special bonus of 2½% (nil); forward, £1,613 (£1,510).

Deritend Stamping Company—Trading loss for the year ended February 28, after charging depreciation, etc., £30,111; E.P.T. refunded, £96,646; balance, £66,535 (£61,554); final dividend of 5%, making 10%; forward, £48,908 (£36,247).

Design by Victor Reinganum

MOSAICS OF STEEL

NUMBER SIX

At the Appleby-Frodingham plant in Lincolnshire there exists a combination of circumstances particularly favourable to the production of structural steels—ores inexpensively mined and adjacent to the furnaces and to the coalfields. In the most modern plants in the country these are smelted and rolled into all manner of steel sections to serve the structural needs of the community. The age of reconstruction will be founded on steel because it is readily available in a multiplicity of forms for architectural design, civil and mechanical engineering and shipbuilding. Despite many new materials, such as the light non-ferrous metals and plastics, steel will remain the basic constructional material where strength and lasting properties are essential.

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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Millfield Engineering, 15, Hickman Street, Wednesfield—£3,500.

Lathkill Metals, 11, Salisbury Square, London, E.C.4—£20,000.

Aluminium Goods, 124, Chancery Lane, London, W.C.2—£10,000. W. R. Earle.

Metal & Steelcraft, Commercial Road, London, N.18—£300. G. H. Fletcher, S. and H. Wreschner.

Hylton Welding Services—£1,000. W. C. Campbell, 3, Violet Street, South Hylton, Co. Durham, subscriber.

Inexco, 23, Welbeck Street, London, W.1—Dealers in metals, etc. £1,000. G. M., C., E. J., and R. Spira.

Parson—Iron and steel merchants, etc. £15,000. K. S. Peacock, Lower Coscombe, Temple Guiting, subscriber.

Pedo, 1, Hatton Garden, London, E.C.1—Engineers, machinery manufacturers, etc. £3,000. H. and E. M. Kilner.

Mordun Engineering, Occupation Road, Abbey Green, Nuneaton—£2,000. W. M. Dunn and C. Morris.

Chas. H. Gallop & Son, West Town, near Bristol—Agricultural engineers. £6,000. C. H. and E. J. Gallop.

Bidsdon, 1, The Close, Fernbank Road, Ascot—Ironmasters, founders, etc. £500. H. Biddulph and A. W. Rixson.

B. M. Ventures—Engineers, etc. £650. C. A. Baker, 5, Windsor House, 98, Sinclair Road, London, W.14, subscriber.

M. A. Madden & Company, 7, Victoria Street, London, S.W.1—Engineers, etc. £6,000. M. A. Madden and R. P. Rivers.

Holmes & Leather, 36, Wilton Place, London, S.W.1—Engineers, etc. £5,000. V. W. Holmes, S. Leather, and C. B. Fish.

Unity Engineers, 4, Hesketh Buildings, Ormskirk Road, Preston, Lancs—£1,000. R. Halstead, E. Clayton, N. Leigh, and R. Balmer.

Raymond Engineering Company, Dean Street, Derby—£2,500. C. Bradshaw, J. A. Brown, S. K. Halliwell, and F. J. Tweddell.

Cooke Bros. (Ironfounders), 72, St. Ives Road, Leicester—Ironfounders and engineers. £35,000. S. H., E. S., and S. J. Cooke.

L. P. Fox & Company, 1a, London Road, Stockton Heath, Warrington—Engineers, founders, etc. £4,000. P. F. Delaney and L. P. Fox.

W. E. Lewsey Engineering Company, 12, Mount Avenue, Ealing, London, W.5—£500. W. E. Lewsey, E. B. Wightman, and A. Golding.

Pugsley & Company, 64, Prince Street, Bristol—Scrap iron and metal merchants. £3,000. K. A. L. Brown, and W. and W. J. Pugsley.

Morson Engineering Company, 99a, Evenlode Crescent, Coundon, Coventry—£1,000. T. B. Law, A. M. Harrison, and J. H. Morris.

Woodland Engineering (Surrey), 78, Victoria Road, Surbiton, Surrey—£500. M. F. Goodwin, P. W. Stoodley, and W. G. F. Thompson.

E. H. Francis (Distributors)—Tool, pattern and machinery designers, etc. £1,000. K. J. Dale, 17, Wallace Road, Coventry, subscriber.

Metalo Products (Croydon), 4, High Street, Croydon—Engineers, founders, etc. £100. S. R. B. Bacon, C. G. and J. M. Belohoubek.

Dale Engineering Company (Cannock), Longford Works, Wolverhampton Road, Wedge Mills, Cannock, Staffs—£2,000. M. and M. M. Smith.

Willis Green & Company, Cambridge Works, Meadow Street, Sheffield—Toolmakers and diesinkers. £10,000. W. and D. Green.

E. T. Pugsley, Harrow Manorway, Abbey Wood, London, S.E.2—Engineers and machinery merchants. £7,000. E. T. Pugsley and H. Clarke.

Hendry Bros. & Crampton, 168, The Broadway, Southall, Middlesex—Stove enamellers, etc. £600. G. R. Crampton, W. T. and S. J. Hendry.

Enterprise Tool & Engineering Company (Glos), Railway Arches, Hare Lane, Gloucester—£400. A. Parker, W. Bottom, A. Clewlow and F. Kevins.

Thos. Hind & Sons (Nottingham)—Scrap iron and metal merchants. £3,000. J., L. and T. Hind, 43, Churchfield Lane, Radford, Nottingham.

Microscopic Grinding Company, 13, Cannon Street, Accrington—Engineers, founders, etc. £3,000. H. A. Procter, A. D. Smith, and H. W. Rogers.

Cleveland Bros., Parkfield Works, Parkfield Road, Saltley, Birmingham—Metal rollers, etc. £15,000. F. Price, L. D., F. F., and H. P. Cleveland.

J. Rock (Oddwork)—Iron and steel forgings manufacturers, etc.—£5,000. J. B. Whelan, "Rosewell," Blackberry Lane, Halesowen, subscriber.

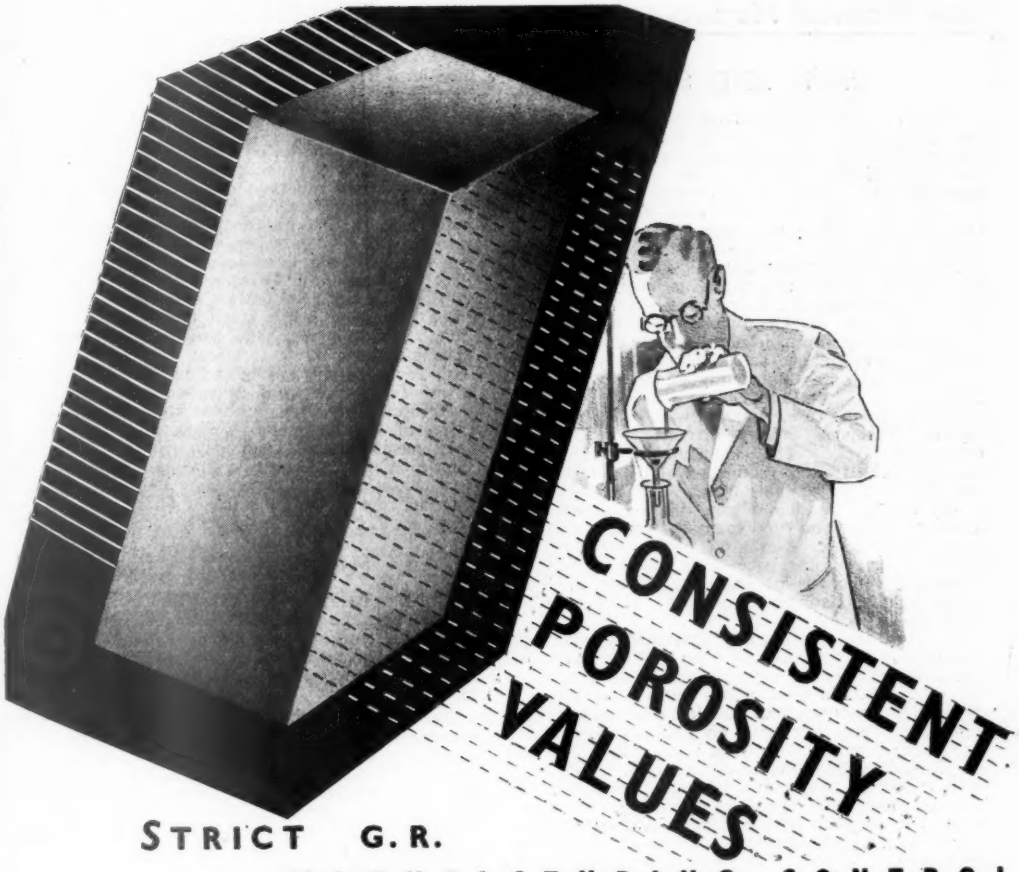
Sam Greenwood & Son, George Street Works, George Street, Mytholmroyd, Yorks—Engineers, etc. £1,000. R. Greenwood, J. S. and F. M. Dobson.

Millard Manufacturing Company, 45, Branston Street, Birmingham, 18—Engineers, toolmakers, etc. £2,000. H. A. Pritchard and T. H. Mills.

Walter Cramp (Birmingham), 118-120, Leopold Street, Birmingham, 12—Manufacturers of metal ware, etc. £1,000. W. H. Cramp and S. H. Davis.

T. Marshlain & Company, 131, Clarendon Park Road, Leicester—Ironmasters, founders, etc. £2,500. T., W. A. and J. Marshlain, and G. H. Lane.

Moorfield Engineering Company (Denton) (1946), Moorfield Works, Manchester Road, Denton, Lancs—£3,000. K. H. Kelly and J. F. Sharples.



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Raw Material Markets

IRON AND STEEL

There is at the moment an appreciable demand for the special pig-iron required by the general engineering, speciality and jobbing foundries for the production of high-duty castings. They have been slower than the light foundries in coming to higher production, but they are now well engaged on civil requirements. Many of them are very active on machinery castings. These foundries in the main use low- and medium-phosphorus pig-iron, but there is a considerable demand also for hematite and for refined iron. Fortunately, the supply position is reasonably satisfactory and the Control are able to give good tonnages in response to licence applications. At times, supplies are well above actual requirements, providing consumers with an opportunity of putting iron into stock.

This is not the case, however, with high-phosphorus pig-iron, produced largely in the Northants and Derbyshire areas. The light-foundry industry is heavily involved in the production of builders' castings and light castings for other trades. It is not too much to say that the housing schemes depend on the light-foundry industry and big expansions will have to take place before long. Output of high-phosphorus iron is just about keeping pace with the production of castings, but there is no margin of safety and there is very little of this iron in stock either at the foundries or at the furnaces.

In addition to pig-iron, large quantities of scrap are necessary in the foundries. In the case of heavy cast-iron and steel scrap, supplies are reasonably good but more light and medium cast scrap is wanted. The engineering foundries use considerable quantities of ferro-alloys, but they have no difficulty in securing their requirements. Supplies of ganister and limestone are plentiful. The foundry coke position, on the other hand, is not too happy. Fuel is tight, and it does not look as though the foundries will have any opportunity this summer of acquiring additional tonnages over current requirements to put by as a reserve for the winter.

It is understood that recently supplies of billets have arrived from overseas, but the quantities now coming forward are not large. The trade could use large tonnages, for home sources cannot meet the demands of the re-rollers as a whole, and some reliance has always been placed on supplies coming from abroad. Before the war semis came from the Continent, but since the war, America, Canada, and Australia have been the sources of supply. Fortunately, home supplies of semis, both sheet bars and billets, have been stepped up in recent months. The sheet mills have many months' work in hand, and there is plenty of business for small bars, special sections, light structural sizes and strip. The re-rollers of bars and strip are taking up any offers from the steelworks of double-sawn crops, defective billets, and any type of raw material which can be usefully put to service.

NON-FERROUS METALS

There is no news as yet of any increase in the price of tin, which did not share in the recent revision of non-ferrous metal prices. A higher quotation for tin is generally considered to be long overdue, but the Ministry of Supply seems to be in no hurry to rectify what is becoming an untenable position. When an increase eventuates it is likely to be substantial.

Copper and lead stocks are at an unduly low level and the supply situation is far from being reassuring. Lead consumers are particularly badly placed. A system of free importation would have prevented this position arising, for when the Metal Exchange was functioning it was possible to buy ahead with confidence, and an unsold balance could always be covered by hedging operations. Many important lead users are to-day receiving but a small proportion of their requirements, the pipe and sheet industry and cable makers being notable instances in this respect. The case for a resumption of normal trading operations in non-ferrous metals is daily becoming stronger.

According to Press reports from Washington, the Office of Metals Reserve is expected to announce the July metal allocations shortly, with copper and tin remaining at the ceiling prices ruling on June 30. Lead and spelter prices, however, may be increased. Some quarters report that the price of tin may be advanced 25 per cent. by August in order to meet world prices.

PUBLICATION RECEIVED

A New Data Sheet. Alar, Limited, of 35, New Broad Street, London, E.C.2, has just issued a further data sheet covering D.T.D. 424. The fullest possible details are given of this general purpose alloy. It is available to our readers on application to the Development Officer.

Bulletin (No. 2) of the Association of Bronze and Brass Founders. The second issue of this bulletin contains a short description by Mr. G. Skript of his visit to American non-ferrous foundries; a report by Mr. P. T. Holligan on the work of the Association's technical committee; metal prices; export prices; a number of short articles on matters of current interest, and a report of the annual meeting.

Light Engineering Practice. We have recently received a copy of a well printed brochure carrying the above title which describes and illustrates the works of Hobbies, Limited, of Dereham, Norfolk. The works have a foundry, well-equipped machine, press and woodworking shops. Though the firm have a worldwide reputation for fret saws, their major output in recent years has been aircraft components.

Slideway Grinding Machines. It is nice to see on the cover of a new catalogue just received from the Churchill Machine Tool Company, Limited, of Altrincham, a well-designed casting in process of having its slideways precision ground. Throughout the book a number of similar illustrations are given showing the wide range of machines available. The catalogue is of that high standard one always associates with Churchill publicity.